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AUTHOR Frizzell, Linda Bane
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ABSTRACT

This study attempted to define the current bases for physical exercise and activity for healthy older adults and to use those data as a basis for developing physical exercises and activities for older adults with mental impairments. An 8-week exercise program was developed and evaluated to determine its effect on satisfaction and quality of life for 24 older adults (ages 73-96) with mental impairments and to provide a demonstration of a comprehensive exercise program for older adults with Alzheimer's disease or dementia living in long-term care facilities. The exercise program was designed to improve physical flexibility of the shoulders, back, and posterior legs and to improve grip strength. The program was designed to consider symptoms and behaviors of the target population, such as short attention spans, cognitive processing deficits, and agnosic reactions. Findings indicated that the exercise program resulted in some improvements and retention of flexibility and strength abilities. The Life Satisfaction Scale (LSS) was administered before and after the program, but 16 of the 24 subjects were unable to complete the LSS interview. Of the remaining eight subjects, all but one showed significant improvement in perceived life satisfaction. (Contains approximately 160 references.) (JDD)

Effects of an Exercise Program on Mentally Impaired Older Adults--Alzheimer's and Dementia Residents in a Long-Term Care Facility

Linda Bane Frizzell, Ph.D.

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The value of physical exercise for healthy older adults has been well established by professionals in a variety of health-related fields. However, few professionals have addressed the exercise needs of the older mentally impaired, diseased, or disabled adult. Most studies involve older adults who live in the public sector (non-institutionalized) and are termed in "good health." This study attempted to define the current bases for physical exercise and activity for the healthy older adult and to use that data as a basis for developing physical exercises and activities for the mentally impaired older adult.

Research studies for the older adult population remain limited even though the proportion of people reaching the age of 65 is dramatically increasing. By the year 2000 the number of persons over age 65 will total 36 million or 13.2 percent of our citizenry (DiGilio & Howe, 1984; Ross, 1983). Further, this population growth is predicted to continue to increase disproportionately to other cohorts into the next century (Boarman, 1989; Daniel, 1984; DiGilio & Howe, 1984; Forman, 1981; Heitmann, 1982; Piscopo, 1985). As the older adult population moves away from "minority" status, its

greater numbers can presumably work to create viable social, political, and personal improvements in their quality of life. The older adult of the future, including the mentally impaired, diseased, and disabled older adult, should be able to expect more services, including trained professionals, to address their needs. Other characteristics of the general emerging population of older adults is that they are better educated, have more funds to purchase services, are less passive and more politically active, and are less dependent upon others for their living environment (Piscopo, 1985). Additional factors influencing the lifestyle of the older population include fixed incomes, inadequate quality of housing, high suicide rates, inflation-reduced buying power, rising medical costs, social isolation, and negative stereotypes of non-working adults.

Included in this age 60+ cohort are older adults who are mentally impaired, diseased, or disabled. Eleven percent of the total United States population are moderately or severely disabled, with approximately 40% of those being over the age of 60 (Kemp, 1983). Kemp also reported that the chances of a person with an early life disability living to older age have also increased. Some epidemiological studies have found that between 4 and 6% of all older adults age 65 and older in this country suffer from an organic brain syndrome. Toseland, Derico, and Owen (1984) reported that percentages of mental impairments are higher for those older individuals seen in inpatient and outpatient health and mental health facilities, reaching as high as 50%. Wright and Whalley (1984) claimed that senile dementia is now a major public health problem, affecting one in twenty of those over age 65, and one in four of

those over age 80. Alzheimer's disease accounts for as many as 90,000-100,000 deaths in the United States per year (Toseland et al., 1984).

Evidence is mounting that regular physical exercise is an important component for maintenance of physical and emotional well being (Blumenthal, Emery, Madden, George, Coleman, Riddle, McKee, Reasoner, & Williams, 1989; Brown, Cundiff, & Thompson, 1989; MacLean, 1982). Exercise programs are becoming an integral part of the care of the institutionalized elderly (LaRocque & Campagna, 1983), adding to the need for diversified exercise programming. This diversity creates a problem for those who program exercises for older adults because their needs and goals are likely to be different from those of the younger population. Successful models for health promotion are often built upon new ideas and new approaches suggested by the older adults themselves (Koss, 1983).

Gender composition is another factor to consider when formulating exercise programs. Because they have a longer life expectancy, women may be the primary clientele of those conducting exercise programs for the elderly. The combination of female gender and old age functions as a socially constructed category defining and delimiting appropriate physical behavior (Vertinsky & Auman, 1988) that should be considered when designing exercise programs for elderly women.

Exercise has a preventive effect on the incidence and progression of chronic diseases often related to the aging process (Brown et al., 1989). Active people, both low and high intensity

exercisers, have significantly lower coronary artery disease (CAD) than do sedentary individuals. Additionally, exercise plays an important role in the treatment of hypertension, obesity, hypercholesterolemia, myocardial infarction, and congestive heart failure (Goldfine, Ward, Taylor, Carlucci, & Rippe, 1991).

It is suggested that sedentary individuals can realize the benefits of exercise participation and significantly reverse certain motor and cognitive declines in performance at almost any age. Further, exercise can benefit disabled persons who have lifestyles similar to the non disabled population but who, because they have been burdened with a disability, are more likely to "age" faster (Kemp, 1983).

The most important aspect of physical activity may be personal fitness goals of the older adult. These goals are likely to include the maintenance of stamina, improved appearance, better elimination, better sleep and, especially important, the sensation of feeling good (Clarke, 1986).

The benefits of physical exercise programming for older adults are well documented. However, few studies have been conducted to ascertain the needs and assess the limitations of the mentally impaired older adult and, in particular, the increasing number of individuals with dementia specifically of the Alzheimer's type.

The purpose of this study was to see if an eight-week exercise program could demonstrate an effect on satisfaction and quality of life for older adults classified as having mental impairments and to provide a demonstration of a comprehensive exercise program for

Alzheimer's- and dementia-afflicted older adults living in a long-term care facility.

This study was designed to demonstrate an exercise program that would improve physical flexibility of the shoulders, back, and posterior legs, and improve grip strength. Improvements in flexibility and strength promote independence of daily functioning. Shoulder girdle flexibility is needed to maintain the ability to feed, dress, groom, and perform everyday duties and activities of daily living (ADLs). Back and posterior leg flexibility (sit and reach fitness) are necessary to perform such daily procedures as tying shoes, picking up objects on the floor, and sitting in a chair. Grip strength is fundamental for efficient performance of daily functions such as personal hygiene, feeding, writing, and operating wheelchairs. The exercises incorporated in this study were tailored to promote physical components of flexibility and strength, helping to produce independence of daily functioning and improve quality of life. A secondary purpose of this study was to note any improvement of self-esteem and perceived life satisfaction from physical movement participation.

The majority of cognitively impaired individuals in the United States live in residential facilities where health care is driven by reimbursement mechanisms, usually focusing exclusively on treatment and rehabilitation of the diagnosed condition with little attention to enhancing the general well-being of the resident (Taylor-Nicholson, Brannon, Mahoney, & Bucher, 1990). Nursing home residents have generally not been targeted for health promotion programs, even though evidence suggests that many nursing home

residents can return to a less restrictive environment if proactive discharge planning takes place early in their stay. LaRocque and Campagna (1983) stated that institutions continue to be structured in a way that fosters dependency and that that dependency may contribute to and accelerate the physical deterioration of the elderly. Institutions must initiate preventive measures to help residents maintain their present state of health and, whenever possible, improve their condition.

Health care and education professionals have tended to overlook the needs and requirements of the mentally impaired for physical exercise and activity programs. Conversely, for the institutionalized elderly, many daily tasks which could provide movement opportunities are often handled by the institution staff. The resident, therefore, becomes dependent on the staff and loses incentive to initiate and to participate in activities (LaRocque & Campagna, 1983). Motivation is needed to promote the physical activity essential for improving quality of life. Meaningful experiences designed to meet the requirements and abilities of all older adults are necessary to promote regular participation in physically active pursuits and thus extend independence, functional abilities, and improved life satisfaction.

Hypothesis

It is necessary to develop meaningful movement experiences especially designed to meet the diverse requirements and abilities of older individuals with mental impairments in order to establish regular participation in physically active pursuits which will ameliorate the dependence, stress, physical complications, and

mental anguish experienced by them. It is hypothesized that, as a result of participation in an exercise program, there will be improvement in life satisfaction, shoulder flexibility, grip strength, and back and posterior leg flexibility in the mentally impaired, older population.

Assumptions

The following assumptions were made regarding this study:

1. The grip dynamometer was calibrated correctly (Quinton, 0-200 ft. lbs.).
2. Other activities of the subjects did not confound the results.
3. Medications were not used to improve physical or mental measurements.
4. The subjects gave maximum effort during measurement.

Physiological and Behavioral Changes of Alzheimer's Disease in Relation to Physical Movement

Dementia may be caused by a number of disorders such as Alzheimer's disease, Jakob-Creutzfeldt's disease, Huntington's chorea, Parkinson's disease, and Pick's disease. Although the symptoms exhibited are often similar, the onset, course, and treatment of these conditions differ significantly from one another (Toseland et al., 1984). Wright and Whalley (1984) reported that dementia has been used as a criterion of aging. This view has been supported by neuropathological studies that have consistently demonstrated that features of Alzheimer's type dementia often occur in brains of non-dementia elderly, and a progressive loss of surface area of neuronal dendrites also occurs as a prelude to

neuronal loss in Alzheimer's and non-Alzheimer's populations. Other researchers suggested that heredity may be a factor. Cohen (1987) reported that there is a genetic basis at least with a small subgroup of families where the disease has more frequently occurred and is identified through the discovery of a genetic marker on chromosome 21 in those particular families. Other literature suggests that a significant relationship exists between Alzheimer's and Down syndrome (Bauer & Shea, 1986; Silverstein, Herbs, Miller, Nasuta, Williams, & White, 1988; Zigman, Schupf, Lubin, & Silverman, 1987). Both are associated with selective loss of cholinergic neurons (those neurons stimulated by acetylcholine), more frequent chromosomal aberrations, and inadequate development of the hippocampus (the part of the brain concerned with memory) (Bauer & Shea, 1986). The neuropathological characteristics of Alzheimer's disease are also found in the brains of individuals with Down syndrome who die after the age of 35 years, but the clinical manifestations of Alzheimer's disease often do not appear (Silverstein et al., 1988).

Alzheimer's disease is a major medical and social problem (Seltzer, Rheaume, Volicer, Fabiszewski, Lyon, Brown, & Volicer, 1988) and is not a normal part of aging (Cohen, 1987). The disease is the cause of serious confusion and forgetfulness in some 2.5 million American adults. Because aging is the principal risk factor associated with Alzheimer's disease, the number of patients with Alzheimer's disease is growing at least as fast as the older United States population (Mortimer, Hepburn, & Maletta, 1985; National Institute on Aging, 1986). In a report to the National Institute on

Aging, Dr. Bruce Schoenberg (1986) reported that twice as many women as men had Alzheimer's disease, and the number of Alzheimer's patients increases with advancing age, from 1% among people 40 years and older to 7% among those 80 years and older.

The disease was first reported by Alois Alzheimer at the turn of the century. It begins with a loss of recent memory and is followed by difficulties with abstraction, problem solving, and judgment (Goreham & Rathge, 1986). Alzheimer's disease is the most common cause of all dementias and is rarely seen in persons below the age of 50 (Rosser, Iversen, Reynolds, Mountjoy, & Roth, 1984). Alzheimer's disease is irreversible and generally averages 8 to 10 years of progressive degeneration, aphasia, and apraxias, ending in a vegetative state (Goreham & Rathge, 1986). Volicer, Seltzer, Rheaume, Fabiszewski, Herz, Shapiro, and Innis (1987) found that half of the Alzheimer's patients were unable to dress themselves five years after onset of symptoms and unable to sleep regularly six years after onset. By seven years after onset, 50% had developed rigidity in passive movement, and by eight years half were unable to feed themselves or walk without assistance. By nine to ten years after onset, 50% had developed contractures of the limbs and were mute, and by 12 years half of those who survived had lost eye contact with caregivers (N = 88, Mean age 68.2).

No single test is able to diagnose Alzheimer's disease. It is the most difficult to diagnose in the early stages as patients seen in medical centers have had the disease for a few years. Physicians who suspect Alzheimer's use a variety of tests, including medical history, clinical examination, blood and other laboratory tests,

psychological tests, and radiologic scans (National Institute on Aging, 1986). To this point, the only definite test to confirm Alzheimer's disease is a post-mortem examination of brain tissue.

The cause of Alzheimer's disease remains unknown. Microscopic brain tissue changes have been described in Alzheimer's disease since Alzheimer first reported them in 1906. These changes consist of plaques, senile or neurotic, which are degenerating nerve cells combined with a form of protein called amyloid and neurofibrillary tangles which are nerve cell malformations. The brains of Alzheimer's patients of all ages reveal these characteristics on autopsy examinations (Cohen, 1987; Rossor, Iversen, Reynolds, Mountjoy, & Roth, 1984).

Considerations of safety are important when working with Alzheimer's patients because of the need to protect the person from wandering, using stairways, and subsequently falling (Cohen, 1987). Another factor is gait and balance in senile dementia of Alzheimer's type. Visser (1983) found that individuals moderately afflicted with Alzheimer's (N = 11) had significantly shorter step length, lower gait speed, lower stepping frequency, greater step-to-step variability, greater double support ratio, and greater path sway. These findings are consistent with the theory that transcortical pathways participating in the integration of gait are damaged in senile dementia of Alzheimer's, thereby possibly explaining Alzheimer's patients' increased incidence of falls.

In summary, it is suggested that physical exercise may produce desirable outcomes to alleviate or slow the process of Alzheimer's disease. Studies have shown that exercise is effective

in reversing, or at least slowing, certain age-related declines in motor performance and in speed of cognitive performance. Exercise may also have an ameliorative effect on the symptoms of Parkinson's disease which shows similar structural degradations to Alzheimer's disease. Rehabilitative effects of exercise may be due to an increase in oxygen to the brain as well as increasing the cerebral metabolic activity which results in improvement in neurological functioning. Regular exercise has psychological benefits such as decreased depression and confusion, as well as the capacity to increase self-esteem and personal worth. Lastly, the use of exercise can provide individuals with a modality that could improve or maintain their functionability and independence in everyday life, thus promoting quality of life and life satisfaction.

METHODS AND PROCEDURES

This study evaluated the effects of an eight-week exercise program on motor performance and life satisfaction of 24 men and women residing in a long-term care facility. Variables tested were shoulder flexibility, sit and reach flexibility, grip strength, and life satisfaction.

The study was designed to demonstrate methods of support and encouragement and to provide guidance in the development and conduct of programs in movement-related activities and leisure based on the needs, interests, and inherent capacities of the older adult who is mentally impaired. Additional goals of this study were to facilitate public and professional understanding of and appreciation for the importance and value of movement-related

activities and leisure skills and to emphasize the complexity of adapting exercise programs to conform to individual differences. Finally, this researcher hopes that this study will encourage interest in research to enrich the depth and scope of movement-related activities and leisure programs for the mentally impaired older adult.

Description of Subjects

The subjects (N = 24) were all volunteers who expressed an interest in physical activity and exercise. The subjects were all residents of a 160-bed long-term care facility that had an activity program as a regularly scheduled program.

The subjects participated in an exercise program three days per week for eight weeks. On one day each week the exercise program was held in a 30' x 40' multipurpose room centrally located in the facility. A smaller 20' x 30' activity room adjacent to this large room was used on the other two days. The subjects all had freedom of movement about the single level facility, although some did not have independent physical mobility abilities. These two rooms were designated for the exercise program to ensure adequate space and to provide for a consistent environment.

The subjects' ages ranged from 73 years to 96 years of age, (M = 87.96). There were 7 males (age range 73-95, M = 86.14) and 17 females (age range 75-96, M = 88.71).

The subjects were all diagnosed as mentally impaired:

9 - Alzheimer's

6 - dementia

2 - cerebrovascular accident

2 - cerebrovascular accident/dementia

2 - chronic brain syndrome

1 - dementia/Parkinson's

1 - organic brain syndrome/Parkinson's disease

Of the sixteen subjects whose educational backgrounds were available, the range of education varied from third grade to teaching and nursing certificates. The mean education level was 9.19 years. Eight of the 24 subjects did not have educational records in their charts.

Instrumentation

The Life Satisfaction Scale (LSS, Lohmann, 1989) interview was used for the pre- and posttest. The LSS is an assessment that measures perceived satisfaction with life. The assessment is quick and easy to give, as it is one page in length with 32 questions (e.g., "I feel just miserable most of the time" agree or disagree). The assessment is designed to establish a person's baseline of satisfaction with life to compare with the results of the same assessment questionnaire over a period of time. The same form was used for both interviews, and any changes in answers were noted.

To test shoulder flexibility, the subjects raised their arms one at a time and reached as high on a 1" x 2" x 6' wooden board as they could. A standard cloth measuring tape was affixed to one side to

determine distance reached. The subjects remained seated in either their wheelchairs or on standard folding chairs if they were ambulatory subjects.

A Quinton Dynamometer was used to determine grip strength. A dynamometer is commonly used by professionals to assess the strength of finger flexion used in motions such as in grasping, squeezing, or closing the hand. Operation is simple; the subject holds the instrument independently in one hand and squeezes the two handles together. The scale records both kilograms and foot pounds. Foot pounds were used as the measurement of choice because of the subjects' clearer understanding of foot pounds and confusion over kilogram measurements.

To test back and posterior upper leg flexibility (sit and reach), a standard yard stick was used with a plastic 90° angle attached perpendicular to the 0" end and another 90° angle attached to the 20" mark. The 90° plastic angle at the 20" mark was to allow the subjects to sit on the floor and place their heels against the angle to produce a reliable measure. The 90° angle at the 0" end of the yardstick was used for subjects who could not sit on the floor to be measured; it was placed against a subject's knees while the subject was on a chair (see Appendix A for an illustration of the measuring device).

The use of a similar measuring device is recommended by AAHPERD in their *Functional Fitness Assessment for Adults Over 60 Years* (1990). They recommend using a yardstick, chalk, or masking tape on the floor, with a mark taped or drawn 20" from the 0" end of the measurement device, as a reference point for heel placement.

This researcher adapted this concept and used the yardstick with 90° plastic angles to allow for a portable measuring instrument. This device was also used to measure more ambulatory individuals.

Orientation of Subjects

The researcher read the subjects' case histories previous to meeting the subjects in order to familiarize herself with their life experiences and to better relate and adapt terminology used in explaining the exercise program and movements for the exercises. The researcher also obtained permission from each subject's physician and guardian to engage in moderate to low energy seated exercises. The researcher obtained a written consent form from each subject signed by the subject and his or her guardian Additionally, the researcher reviewed any limitations or conditions (e.g., physical, psychological, emotional, behavioral, and medications) that would contraindicate exercise participation.

Two weeks before the start of the research project, the researcher met with the subjects who had volunteered to be in the exercise program. The objective was for the researcher to answer any questions the subjects had and to develop rapport, promoting a relaxed environment by becoming acquainted with the subjects.

The researcher provided the subjects with a verbal and written description and reason for conducting this research project. Subjects were reassured that there would be no risk to their health and that they could withdraw from the project at any time. The researcher explained that she would interview each person before and after the study to assess level of life satisfaction. The

subjects were verbally assured that they did not have to answer any questions that made them uncomfortable.

The exercises and games that would be incorporated each week for eight weeks were explained in detail to the subjects. The subjects were told that they would be measured weekly for eight weeks for shoulder flexibility, back and leg flexibility, and grip strength. The researcher let the subjects examine at their leisure the equipment that would be used during the study, and she demonstrated its application. The researcher assured the subjects that all equipment was age appropriate and that extreme care would be given to respect each subject's dignity and promote self-respect.

Additionally, approval to conduct this research was obtained from the University of North Dakota's Institutional Review Board

Test Administration

One week before the exercise program started, the subjects were all given the LSS. The interview was given verbally with the researcher reading the question (in second person) to the subject. Each subject was interviewed one at a time in a quiet private area (either his or her private room or an empty day room). Not all of the subjects could respond with appropriate answers to the questions, nor could some remain on task long enough for all questions to be read (32 questions). Those subjects who could not respond appropriately (N = 16), were not included in the life satisfaction analysis. The eight subjects who did complete the life satisfaction pretest were given a posttest consisting of the same questionnaire.

The subjects were tested on the first day of the exercise training for shoulder, elbow, and finger flexibility, using the 6'

measuring stick described in the instrumentation section. The subjects were in a seated position and were requested to extend their arm as high up the stick as they could reach while remaining seated. After a measurement was obtained, the same procedure was repeated for the opposite arm. This measurement was taken every week for eight weeks. The subjects used their same wheelchairs or, if they were ambulatory, the same folding chairs every week for measurement. The measurement stick was placed adjacent to the head of the humerus each time a measurement was taken. Subjects were given warm-up stretching exercises prior to being measured. Subjects were allowed adequate time to stretch and reach as far as possible for measurement.

The next measurement taken was grip strength. Subjects took up to three practice tries on the dynamometer for warm-up before being measured. Then subjects were told to squeeze the handles of the dynamometer together as hard as they could for measurement. Subjects were given three tries on each hand with the best effort recorded for each.

The last measurement taken was for sit and reach flexibility. The subjects were either assisted to the floor for measurement, or they were measured in a seated position if they could not safely be transferred to the floor. The subjects were measured with a modified yard stick as described in the instrumentation section. The subjects who were measured on the floor were instructed to place their heels in the 90° plastic angle that was attached to the yardstick at the 20" mark (the same basic protocol as the AAHPERD assessment for older adults). They were then instructed to bend

forward with both hands together, one on top of the other and reach forward as far as they could while keeping their legs straight. The measurement was taken at the farthest point the subject could hold the stretch for two seconds. Each subject was given adequate time to warm up and stretch prior to test administration. The measurement was taken at the farthest point the subject could hold the stretch for two seconds.

The subjects who could not be seated on the floor were measured in the seated position using the same instrument but with the 0" end of the yardstick with plastic 90° angle held against their bent knees by the researcher. The researcher then requested the subject to bend forward as far as possible with one hand on top of the other, sliding their hands forward as far as possible. The measurement was taken at the farthest point the subject could hold the stretch for two seconds. These subjects were also given adequate time to warm up and stretch prior to measurement. Warm up and stretching for both groups consisted of performing similar movements of muscles to be stretched using static techniques for five seconds with three repetitions.

All three of these measurements—shoulder flexibility, grip strength, and sit and reach flexibility—were taken each week for eight weeks during the exercise program. The pretest was the first day of the first week of the exercise program with subsequent measures taken midweek; the posttest was the last day of the eighth week of the exercise program.

Procedures

The subjects were scheduled to participate in a moderate to low intensity exercise class on Tuesday and Thursday for an eight-week period. (Wednesdays were used for testing; see Test Administration.) The time of day was the same as the institution's regular time for activities and lasted for 30 minutes each day. The subjects were involved only in exercises that were done from a seated position.

The subjects were seated in a large circle with the researcher and other staff in the center to provide visual and verbal reinforcement. Every exercise period began with a five-minute warm-up consisting of static stretching of arms, legs, back, and neck. Subjects who required assistance in moving limbs were assisted by staff and the researcher using a passive range of motion (PROM) technique to ensure subject readiness for exercise.

On Tuesdays the activity was a game with a large multicolored lightweight vinyl 4' beach ball. The lightweight ball was used to protect subjects who did not have fast reaction times or did not or could not respond to the action of the ball when it was passed to them. Subjects could be bumped by this ball and not sustain any injuries. The subjects were encouraged to throw, punch, push, or hit with their head, shoulder, knee, or foot the two 4' balls around the circle to other subjects or staff. There was only one rule to the game: everyone had to remain seated. If the ball went out of the circle, it was retrieved by a staff person. The subjects received verbal encouragement and acknowledgment every time they touched the ball. No movement was judged to be "bad." Subjects' names were

used as additional reinforcement and recognition when they actively attempted any participation in the game. The size and colors of the balls were visually stimulating for the subjects to activate a reflexive response to participate.

Wednesdays were used for measurements but always began with a five-minute warm up (see procedure in Test Administration) before measurements were taken. The subjects were all assembled in one of the activity rooms for measurements and were encouraged to support each other's attempts as well as watch others being measured. The researcher verbally encouraged the subjects to perform to the best of their abilities and always concluded measurements with positive compliments for each subject's efforts.

On Thursdays of each week, the subjects used exercise stretch bands that were made by the researcher of surgical rubber tubing. Two sizes of rubber tubing were used, a small 1/8" diameter and a 1/4" diameter latex composition stretch tubing. The smaller diameter tubing was used by the subjects who had low arm strength while the larger diameter tubing was used by those who effortlessly stretched the small diameter tubing. Handles of plastic electrical conduit were clinched to the ends of the tubing to provide an easy grip for the subjects. The plastic conduit ranged from 3/8" to 1" diameter to accommodate differing hand sizes and abilities to flex fingers due to arthritis or other functional difficulties.

The subjects were seated in a circle; the researcher visually and verbally demonstrated the use of the exercise bands in the center of the circle. The researcher and other staff provided any individual instruction and assistance in understanding the use of the

exercise bands. The subjects were verbally encouraged to stretch the exercise band as far as they could, holding the exercise band in front of their chest and moving their arms laterally. Two sets of five repetitions were the minimum, with some subjects able to accomplish a maximum of five sets of five repetitions. Some hemiplegic subjects did not do the lateral arm movements. Instead they had the exercise band fastened at one end to either their foot or wheelchair bracket; they then performed arm curls on the unaffected side for a minimum of two sets of five repetitions to a maximum of five sets of five repetitions.

All subjects were able to do the single arm overhead press. Those who were not bilateral had the exercise band once again hooked to their foot or wheelchair; then they raised their arm as high over their head as they could stretch the exercise band with their palm out. Those who had use of both arms and hands held one end of the exercise band at waist level and raised their other hand (palm out) as far as they could stretch the exercise band over their head. Each did a minimum of one set of five repetitions to a maximum of three sets of five repetitions. Subjects were told that they could stop at any time if they felt too tired to continue or if it was too painful to participate. Verbal encouragement and praise were given by the researcher and other staff to promote active participation.

Design and Analysis

The data were analyzed in two stages. First the numeric data were analyzed on the available information for a given measurement. Generally, subjects were tested weekly, but group composition was inconsistent at any given point in time, principally due to a subject's handicapping conditions and current physical health but also due to a subject's occasional refusal to participate on a given day.

The SPSSX system was used to compute means and standard deviations for the variables of gender composition, age, education, attendance, shoulder flexibility, grip strength, and modified sit and reach. Paired pre- and posttests of right and left shoulder flexibility, right and left grip strength, and modified sit and reach were computed using a *t*-test.

RESULTS

Range, means, and standard deviations of performance variables were reported for each week of the study. A paired *t*-test was conducted on the performance variable when pretest (week 1) and posttest (week 8) scores of the same subjects were available. Illustrations are provided to show patterns and trends of weekly measurements. The analysis of the results from the LSS assessment follows these statistical correlations.

Comparative Data

The subjects in this study were predominantly female (71%) and in the eighth and ninth decade of life. With the exception of one individual, all were born and lived in the Midwest their entire lives. All had the opportunity of attending 24 days of this program. Table 1 shows means and standard deviations for the following variables: age, education, and attendance at exercise sessions.

TABLE 1

Characteristics of Subjects

N = 24	Mean	SD
Age	87	6.67 years
Education	8th grade ed.	1.29 years
Attendance at sessions	15.09 days	6.47 days

Results of tests of performance variables suggest that there was improvement. Right shoulder flexibility showed an improvement from a mean of 52.72" to a mean of 62.31", a mean increase of 9.59". Left shoulder flexibility showed less improvement with an initial measurement mean of 56.73" and a final measurement mean of 60.36", a mean increase of 3.63" (see Figure 1).

Mean of Right and Left Shoulder Flexibility of Mentally Impaired Persons Available for Testing

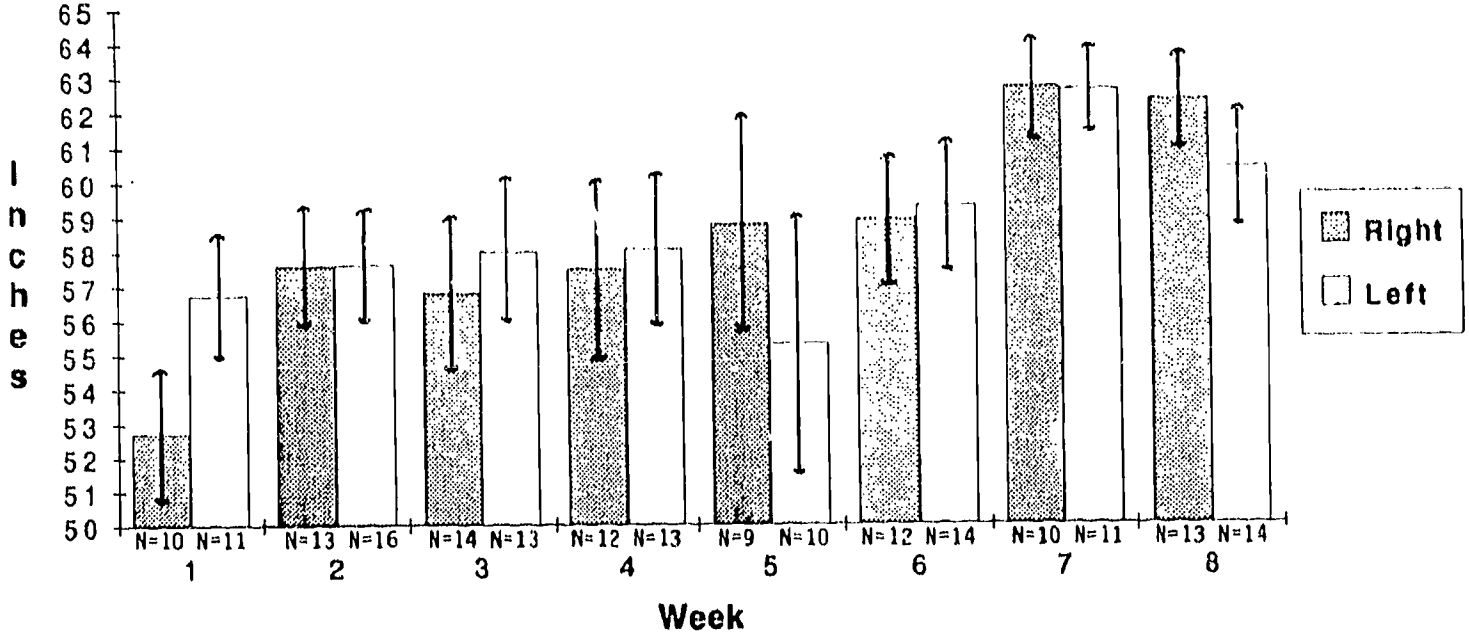

FIGURE 1

Table 2 indicates ranges, means, and standard deviations for right shoulder flexibility for each week for subjects available for measurement. Similar measurements for left shoulder flexibility are shown on Table 3.

Subject composition at measurement sessions for shoulder flexibility varied, contributing to fluctuations in range of scores. Note the weekly changes in mean scores (see Figures 2 and 3).

A paired *t*-test using the same individuals in week 1 and week 8 found significance in improvement of right shoulder flexibility, $t = 4.34$, $p < .005$ (see Table 4). A paired *t*-test was used to compare left shoulder flexibility, but analysis indicated that improvement was not significant, $t = 1.92$, $p > .097$ (see Table 5).

Right hand grip strength showed an apparent numerical improvement from a mean of 8.38 ft.lbs. to a mean of 17.44 ft.lbs., a mean increase of 9.06 ft.lbs. Left hand grip strength showed similar results with an initial measurement of a mean of 4.44 ft.lbs. and a final measurement mean of 11.20 ft.lbs., a mean increase of 6.76 ft.lbs. (see Figure 4). No explanation was found for the difference in the amount of improvement for the left hand and right hand, a mean difference of 2.3 ft.lbs. Table 6 shows the range, mean, and standard deviation for right hand grip strength. Table 7 shows similar statistics for left hand grip strength. (No measurements were taken in week five due to administration difficulties.) Subject composition varied at measurement sessions, contributing to fluctuations in range of scores (see Figures 5 and 6).

TABLE 2

Right Shoulder Flexibility for Persons Available for Testing (Varying on a Weekly Basis) Using Older Adults With Mental Impairments

Week	n	Range (in inches)	Mean (in inches)	SD (in inches)	SE Mean
1	10	43-61	52.72	6.91	2.19
2	13	42-67	57.61	6.76	1.88
3	14	42-67	56.79	8.27	2.21
4	12	40-71	57.50	9.35	2.70
5	9	42-73	58.78	10.18	3.39
6	12	45-72	58.92	6.87	1.98
7	10	53-70	62.70	4.81	1.52
8	13	51-73	62.31	5.51	1.53

TABLE 3

Left Shoulder Flexibility for Persons Available for Testing (Varying on a Weekly Basis) Using Older Adults With Mental Impairments

Week	n	Range (in inches)	Mean (in inches)	SD (in inches)	SE Mean
1	11	43-63	56.73	6.51	1.96
2	16	41-66	57.63	6.88	1.72
3	13	45-71	58.00	7.89	2.19
4	13	43-73	58.08	8.64	2.40
5	10	34-70	55.30	12.69	4.01
6	14	45-73	59.29	7.74	2.07
7	11	54-71	62.64	4.30	1.30
8	14	48-72	60.36	6.91	1.85

FIGURE 2

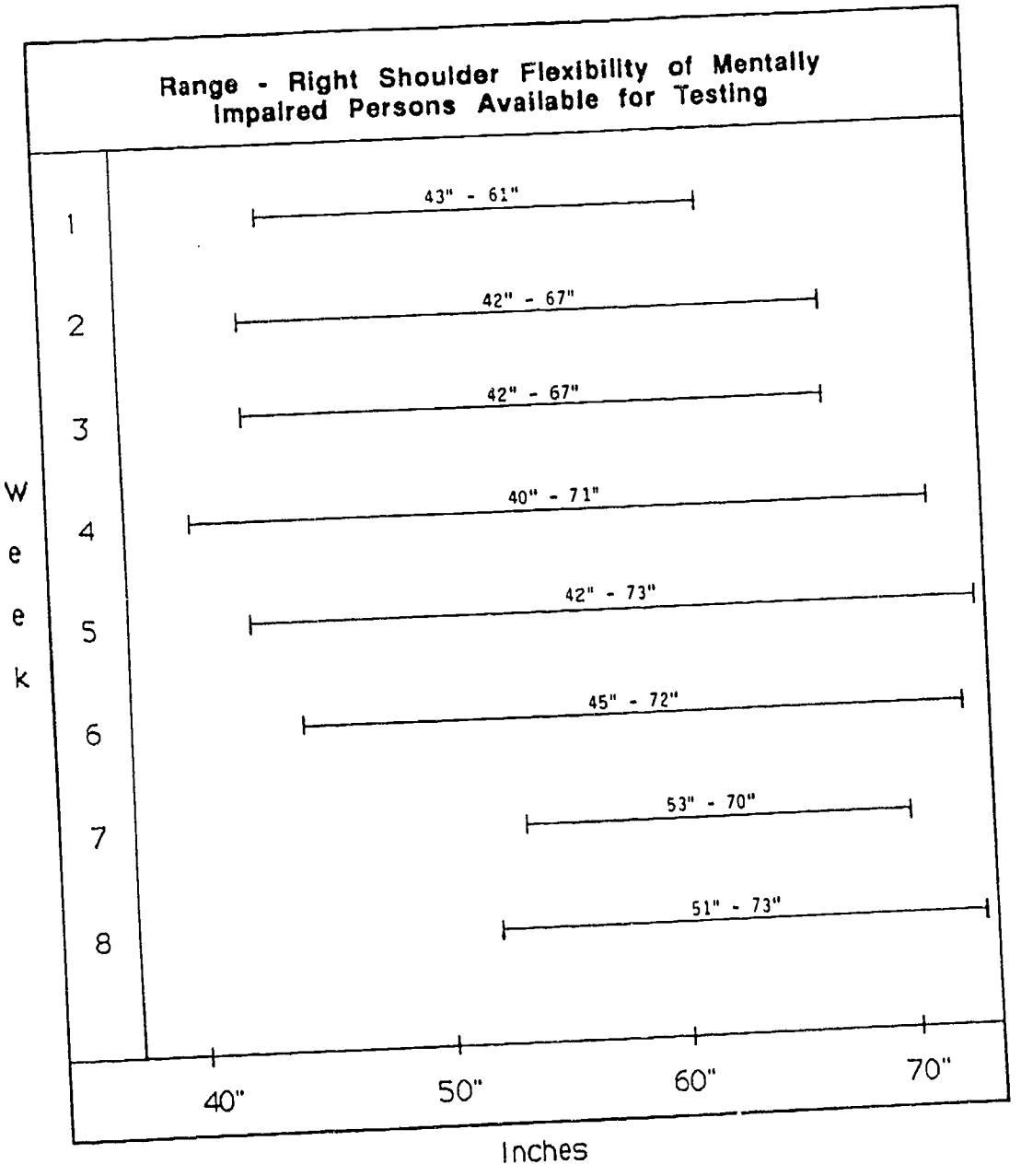
Range - Right Shoulder Flexibility of Mentally Impaired Persons Available for Testing
Week
1
2
3
4
5
6
7
8
43" - 61"
42" - 67"
42" - 67"
40" - 71"
42" - 73"
45" - 72"
53" - 70"
51" - 73"
40"
50"
60"
70"
Inches

FIGURE 3

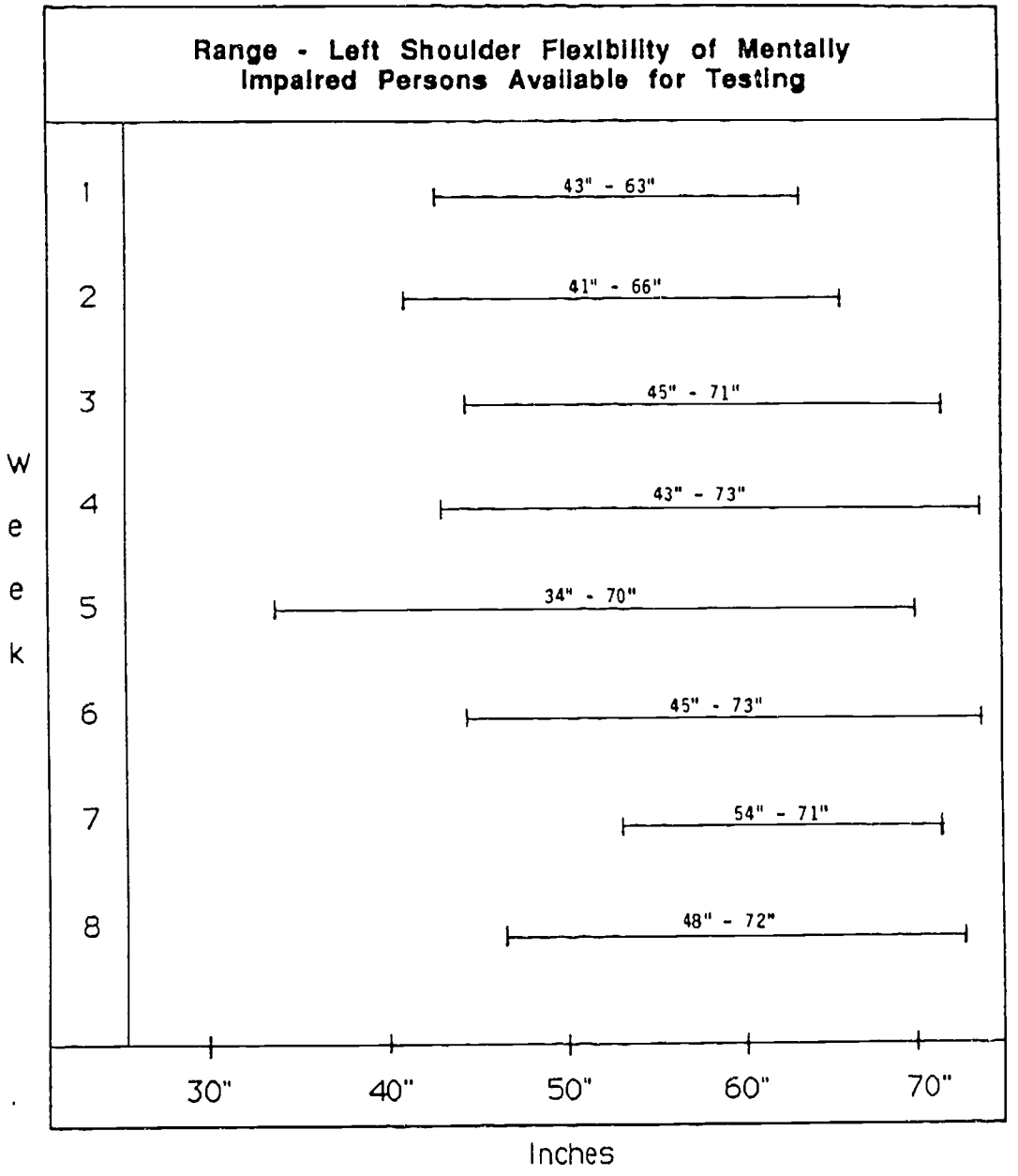
Range - Left Shoulder Flexibility of Mentally Impaired Persons Available for Testing
Week
1
2
3
4
5
6
7
8
43" - 63"
41" - 66"
45" - 71"
43" - 73"
34" - 70"
45" - 73"
54" - 71"
48" - 72"
30"
40"
50"
60"
70"
Inches

TABLE 4

Right Shoulder Paired *t*-test for Persons Available for Testing (In Week 1 and Week 8) Using Older Adults With Mental Impairments

Week	Range (in inches)	Mean (in inches)	df	SD (in inches)	
1	43-61	54.14	6	7.27	$t = 4.34$
8	51-73	61.00		5.39	$p < .005$

TABLE 5

Left Shoulder Paired *t*-test for Persons Available for Testing (In Week 1 and Week 8) Using Older Adults With Mental Impairments

Week	Range (in inches)	Mean (in inches)	df	SD (in inches)	
1	43-63	55.88	7	7.18	$t = 1.92$
8	48-72	59.50		6.63	$p > .097$

FIGURE 4

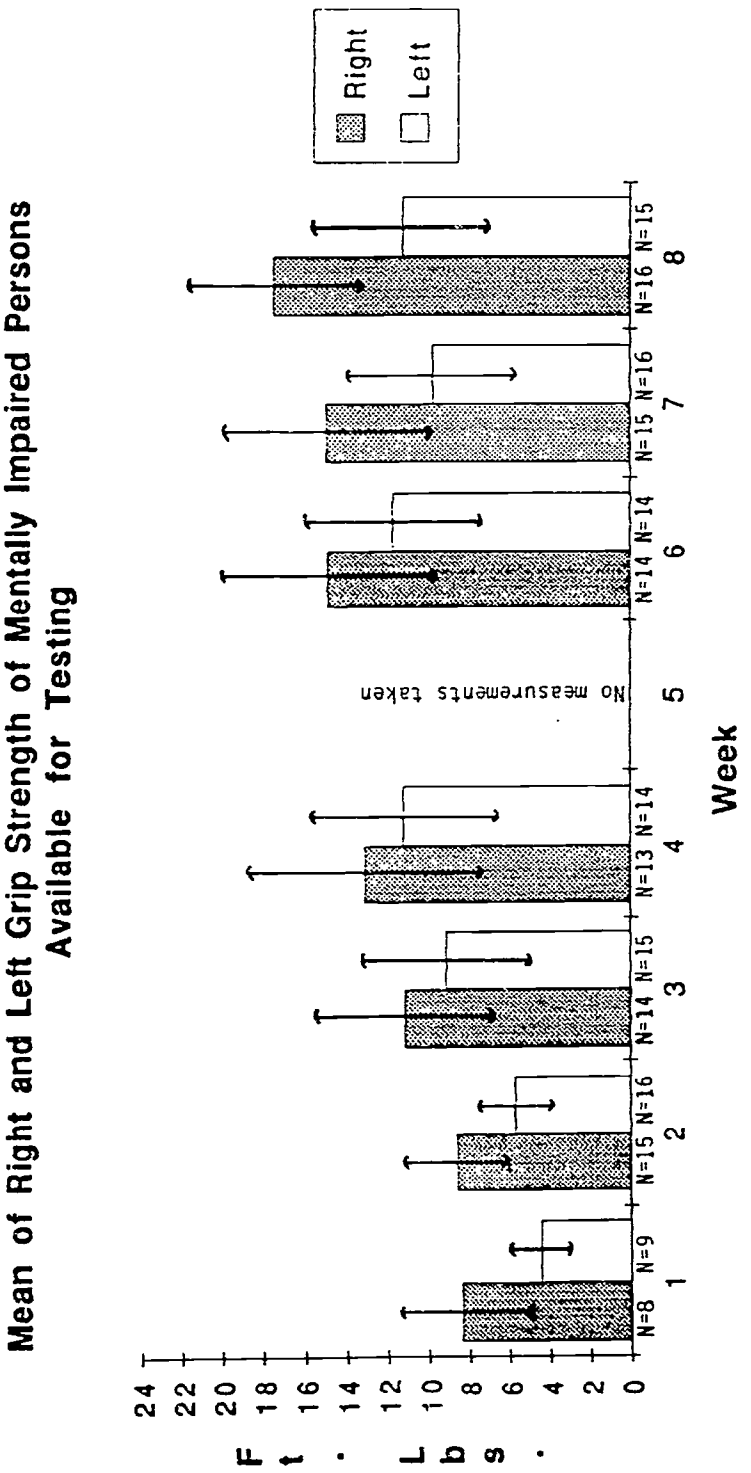
Mean of Right and Left Grip Strength of Mentally Impaired Persons Available for Testing
Right
Left
Ft. Lbs.
0
2
4
6
8
10
12
14
16
18
20
22
24
N=8 N=9 N=15 N=16 N=14 N=15 N=13 N=14 N=14 N=15 N=15 N=16
1 2 3 4 5 6 7 8
Week
No measurements taken

TABLE 6

Right Hand Grip Strength for Persons Available for Testing (Varying on a Weekly Basis) Using Older Adults With Mental Impairments

Week	n	Range (~~in inches~~) Ft. lbs	Mean (~~in inches~~) FT. lbs	SD (~~in inches~~) FT. lbs,	SE Mean
1	8	0-25	8.38	9.69	3.42
2	15	0-35	8.60	11.05	2.85
3	14	0-60	11.14	17.22	4.60
4	13	0-72	13.08	21.57	5.98
5					
6	14	0-74	14.86	20.88	5.58
7	15	0-80	14.93	21.05	5.43
8	16	0-68	17.44	18.16	4.54

TABLE 7

Left Hand Grip Strength for Persons Available for Testing (Varying on a Weekly Basis) Using Older Adults With Mental Impairments

Week	n	Range (~~in inches~~) FT. lbs	Mean (~~in inches~~) FT. lbs.	SD (~~in inches~~) FT. lbs	SE Mean
1	9	0-10	4.44	5.27	1.76
2	16	0-22	5.69	8.20	2.05
3	15	0-65	9.13	17.03	4.40
4	14	0-60	11.21	18.43	4.93
5					
6	14	0-65	11.17	17.46	4.67
7	16	0-68	9.75	17.35	4.34
8	15	0-70	11.20	18.45	4.76

Although the data indicate an apparent improvement in grip strength, significance was not approached for right hand grip strength, $t = 2.11$, $p > .103$, or left hand grip strength, $t = 1.00$, $p > .374$ (see Tables 8 and 9).

Modified sit and reach flexibility began with an overall mean measurement of 14" and an ended with an overall mean measurement of 19.29", a mean gain of 5.29". (Table 10 shows range, means, and standard deviations for modified sit and reach.) The subject composition varied at measurement sessions, contributing to fluctuation in mean scores (see Figure 7). Ranges of scores are provided in Figure 8. Although some improvement was shown significance levels were not reached, $t = 1.33$, $p > .410$ (see Table 11).

Life Satisfaction Assessment

The Life Satisfaction Scale (LSS) was used as both a pre- and posttest. Questions on the LSS are worded in the first person for individuals who are able to read and write independently as well as stay on task long enough to do the 32 questions. Instructions in the manual (Lohmann, 1989) recommend that the LSS be given orally if an individual has difficulty reading or writing independently. Therefore, the researcher read the interview questions from the LSS in the second person to each subject individually.

FIGURE 5

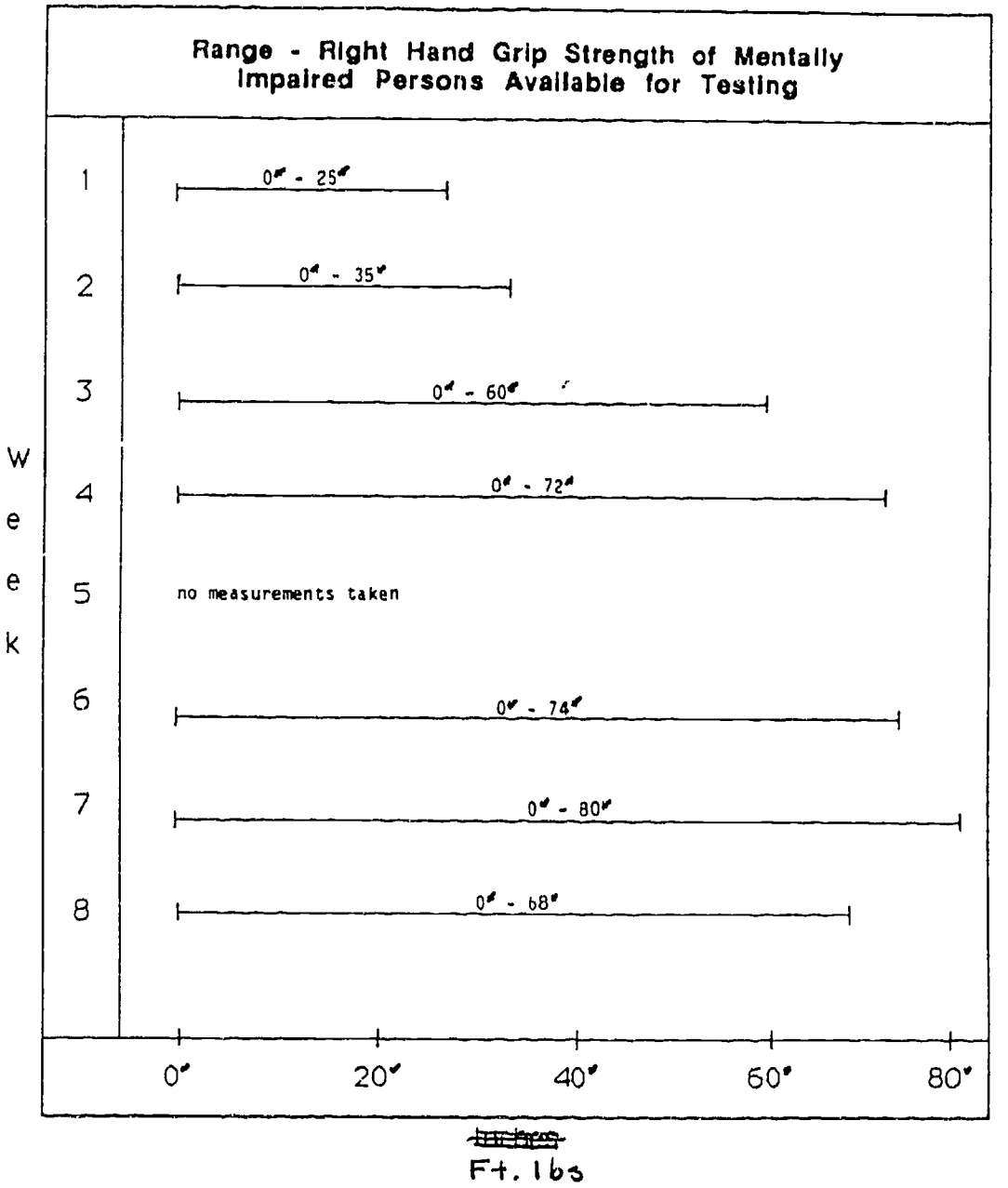
Range - Right Hand Grip Strength of Mentally Impaired Persons Available for Testing
Week
1
0° - 25°
2
0° - 35°
3
0° - 60°
4
0° - 72°
5
no measurements taken
6
0° - 74°
7
0° - 80°
8
0° - 68°
0°
20°
40°
60°
80°
Ft. lbs

FIGURE 6

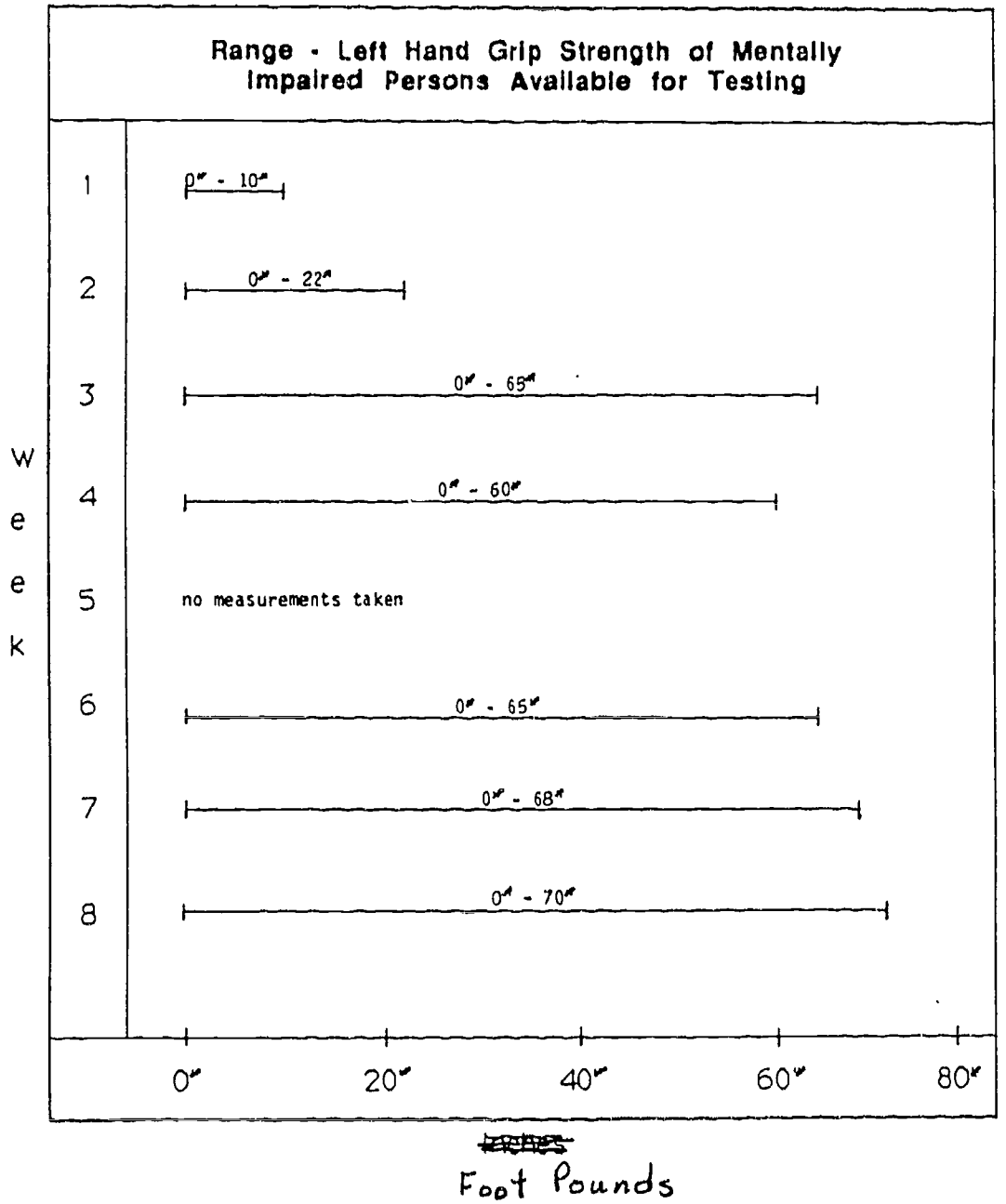
Range - Left Hand Grip Strength of Mentally Impaired Persons Available for Testing
Week
1
0" - 10"
2
0" - 22"
3
0" - 65"
4
0" - 60"
5
no measurements taken
6
0" - 65"
7
0" - 68"
8
0" - 70"
0"
20"
40"
60"
80"
Inches
Foot Pounds

TABLE 8

Right Hand Grip Strength Paired *t*-test for Persons Available for Testing (In Week 1 and Week 8) Using Older Adults With Mental Impairments

Week	Range (~~in inches~~) Ft. lbs.	Mean (~~in inches~~) Ft. lbs.	df	SD (~~in inches~~) Ft. lbs	
1	0-25	8.40	4	10.50	$t = 2.11$
8	2-68	14.40		16.47	$p > .103$

TABLE 9

Left Hand Grip Strength Paired *t*-test for Persons Available for Testing (In Week 1 and Week 8) Using Older Adults With Mental Impairments

Week	Range (~~in inches~~) Ft. lbs	Mean (~~in inches~~) Ft. lbs	df	SD (~~in inches~~) Ft. lbs	
1	0-10	4.00	4	5.48	$t = 1.00$
8	2-70	2.40		4.34	$p > .374$

TABLE 10

Modified Sit and Reach Flexibility for Persons Available for Testing (Varying on a Weekly Basis) Using Older Adults With Mental Impairments

Week	n	Range (in inches)	Mean (in inches)	SD (in inches)	SE Mean
1	2	13-16	14.00	1.41	1.00
2	9	9-22	13.56	3.97	1.32
3	5	10-27	15.40	6.80	3.04
4	6	9-27	15.50	6.63	2.71
5	1	16	16.00	--	
6	8	7-21	14.75	5.26	1.86
7	6	10-30	20.00	7.56	3.09
8	7	14-29	19.29	4.75	1.80

FIGURE 7

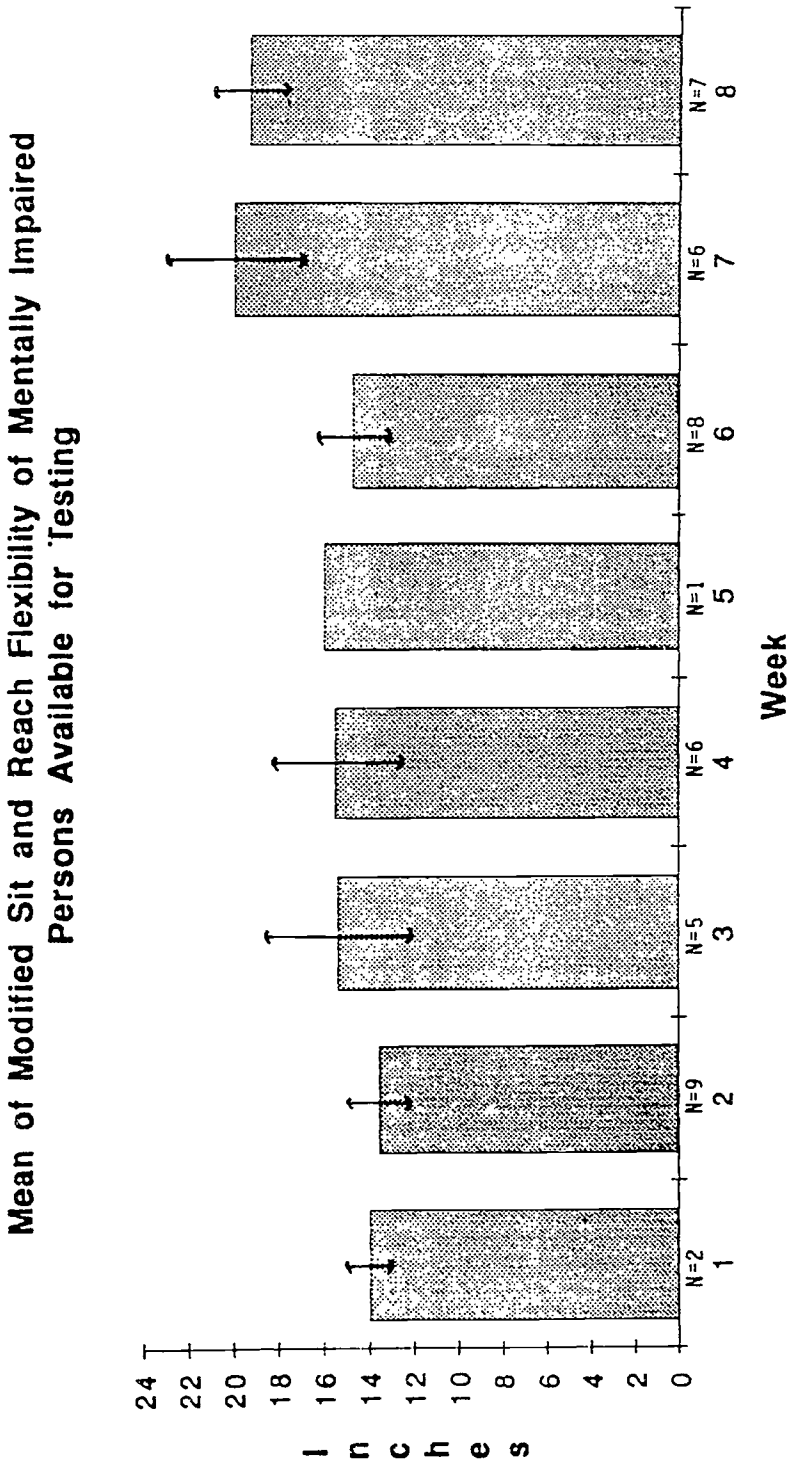
Mean of Modified Sit and Reach Flexibility of Mentally Impaired Persons Available for Testing
Inches
0
2
4
6
8
10
12
14
16
18
20
22
24
N=2
1
N=9
2
N=5
3
N=6
4
N=1
5
N=8
6
N=6
7
N=7
8
Week

FIGURE 8

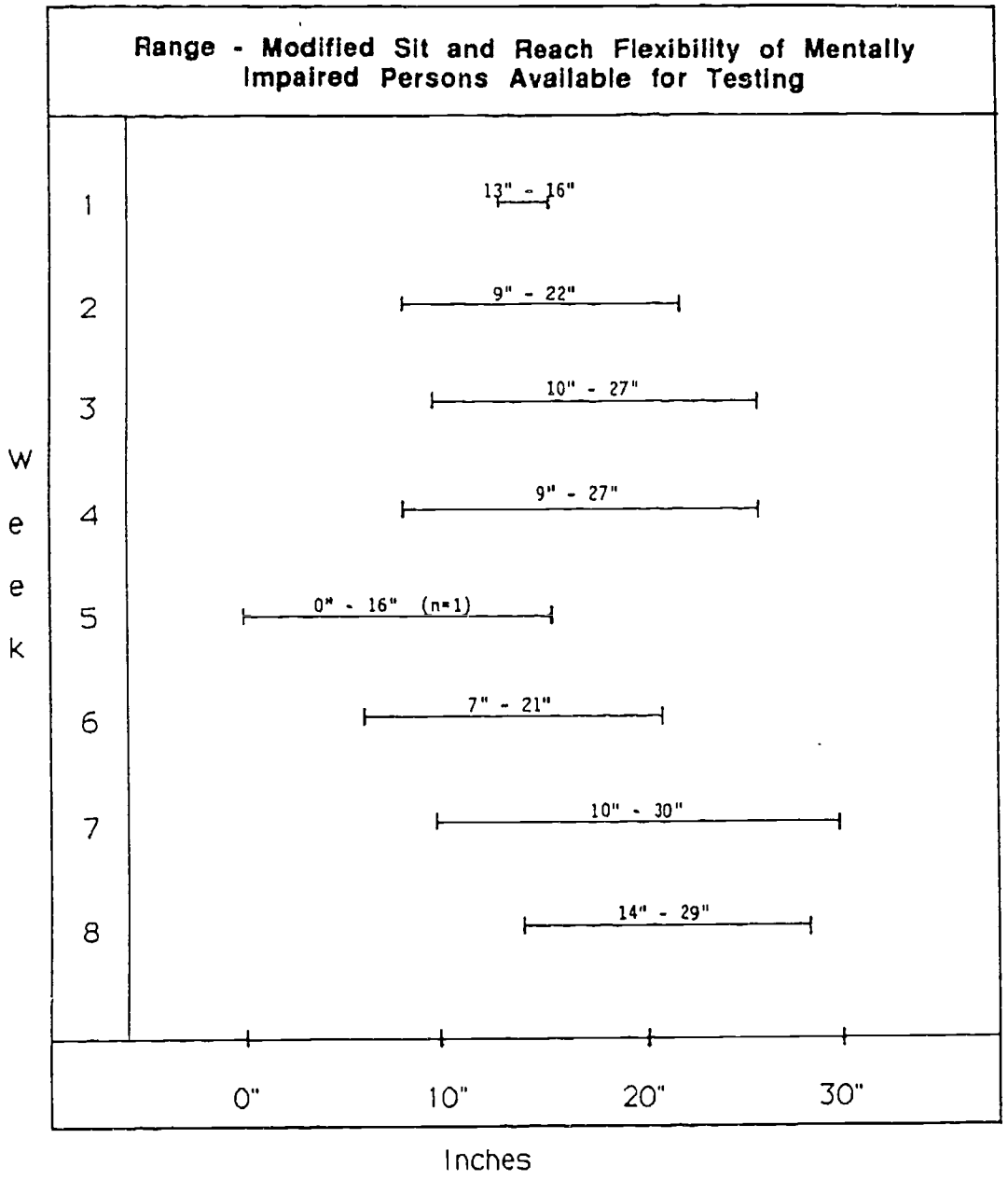
Range - Modified Sit and Reach Flexibility of Mentally Impaired Persons Available for Testing
Week
1
2
3
4
5
6
7
8
13" - 16"
9" - 22"
10" - 27"
9" - 27"
0" - 16" (n=1)
7" - 21"
10" - 30"
14" - 29"
0"
10"
20"
30"
Inches

TABLE 11

Modified Sit and Reach Flexibility Paired *t*-test for Persons Available for Testing (In Week 1 and Week 8) Using Older Adults With Mental Impairments

Week	Range (in inches)	Mean (in inches)	df	SD (in inches)	
1	13-15	14.00	1	1.41	$t = 1.33$
8	14-29	18.00		2.83	$p > .410$

Sixteen of the 24 subjects were unable to complete the LSS interview. Reasons for inability to complete the LSS included subjects' inability to understand the questions, subjects' inappropriate answers, and some subjects' lack of capability to be stimulated to respond with either gesture or voice. One subject who completed the LSS was aphasic and responded with gestures of approval or disapproval. The results of eight subjects' responses (n = 8) were scored. A total of 32 points are possible on the LSS. The higher the score, the greater the subject's perceived satisfaction with life. The LSS does not include a standardized breakdown as to which scores indicate high, medium, or low satisfaction with life. The LSS is best used to compare perceived life satisfaction of one subject from one testing time to another. Data on Table 12 provides information about the results of the LSS.

The scores on the pretest ranged from 2 to 24, with a mean score of 10.4. The eight subjects who had completed the pretest were reassessed for change in satisfaction of life after the eight-week exercise program. The scores on the posttest ranged from 5 to 25, with a mean score of 14.2. All subjects but one, whose score remained the same, showed significant improvement in perceived life satisfaction ($t = 8.91$, $p < .001$).

Summary

This study has provided evidence that physical exercise can be of value to mentally impaired older adults. Results of this eight-week study show some improvements and retention of flexibility and strength abilities as well as improvement in life satisfaction.

The exercise program was adapted from contemporary programs for healthy older adults. During the development of the design of this program, special considerations were given for symptoms and behaviors that accompany individuals with Alzheimer's disease, dementia, and other cognitive impairments. These symptoms and behaviors include short attention spans, cognitive processing deficits, and agnosic reactions (loss of auditory, visual, or other sensations although the sensory sphere is intact). Other considerations such as poor eyesight, hearing deficits, slowed movements, and decreased exercise capacity are commonly found in all populations of older adults but were also considered because of the confounding effect they have on individuals with cognitive impairments.

Due to the various ages and physical functioning levels of the subjects in this study, a low intensity mode of exercise was chosen. The subjects in this study were not capable of performing exercises at the ACSM's recommended levels of intensity (19 subjects used wheelchairs). Thus, it seemed practical to start at the highest physical functioning level of each subject and attempt to improve physical fitness progressively. Improvising a program that allows for successful personal levels of participation is not uncommon in institutional settings. To provide for individual success, the program must have goals that are attainable by all participants. In this study those higher functioning individuals achieved the same goals as the lower functioning individuals; however, those with higher functioning levels achieved the goals more frequently by using superior skills. Several trained staff were available to provide the one-to-one facilitation needed by some participants to stimulate alternative motor pathways for the subjects to adapt movements enabling them to reach their goal.

Basic exercise concepts can be used to promote the sense of movement that is inherent in human activity, to encourage the ability to respond, and to support or improve quality of life. Possibly older adults have not been encouraged strongly or convincingly enough to motivate them to enjoy the benefits of exercise. To be free to enjoy movement and its sense of well being is clearly related to physical condition, social expectations, exercise knowledge, and personal goals. Exercise programming based on facts and individual needs and abilities should be available

for all older adults, including the mentally impaired, diseased, and disabled older adults.

Additional recommendations are in the context of preparation for exercise programming. It must be emphasized that great care and research of each exercise participant's medical history and life experiences be performed before a program is developed for that individual. Simple considerations such as learning life histories of Alzheimer's diseased individuals can make the difference in facilitator-participant communication success by using familiar modes of object associations. These earlier life associations to movement are helpful to all older adults by creating an environment of understandable, previously experienced motor patterns.

Short attention spans must be considered in allowing extra time to reintroduce exercises or movements over and over again. Methods of stimulating movement, using reflexive, proprioceptive, visual, or verbal cues should be considered as common procedures to be incorporated into a comprehensive exercise program, as well as precautions in dealing with maladaptive behaviors.

The facilitation of the program may require spontaneity. The subjects in this study were of all levels of mental and physical function, requiring diversity of instruction and adaptation to learning exercise movements. It is imperative that the exercise leader be well versed in alternative methods of stimulating volunteer physical movement as well as realizing benefits of various levels of exercise participation. Success levels in exercise programs cannot always be gauged objectively. It should be understood that to some individuals the ability to voluntarily move

one finger or support a smile may be a landmark accomplishment and may not be readily recognized by observation. Additionally, there may be other stimulating factors in an exercise setting that are unexplained and unobservable that may cause uncharacteristic behaviors and reactions by the exercise participants.

Limitations

Generalizability of the results of this study are limited by several factors:

1. The quality of consistent/stimulating instruction of exercise was difficult due to differences of subjects' mental and physical skill levels within any given group.

2. The emotional and physical state of the subjects changed radically and without warning due to environmental conditions of the exercise area.

3. The ability of the subjects to comprehend verbal instruction was dependent upon voice levels, local dialects, age appropriate relationships (e.g., vocabulary), and the lack of ability to remain on task long enough to process verbal communication.

4. The visual acuity of the participants during exercise demonstration and sessions was restricted by functional, organic, or effects of medications. These limitations may not be constant or permanent and may be behavior related.

5. This study was limited to seven measurements of grip strength due to test administration difficulties in week 5.

6. The subjects in the long-term care facility used in this study resided there due to any or a combination of factors including financial, care need, social implications, and a familial prerogative for choice of placement in the long term care facility.

7. Subject composition for weekly group measurements limited the statistical analysis that could be performed to test for areas of significance.

8. The attendance and test measurements were at times limited by refusal to participate; the reasons for these occurrences were difficult to determine in this population of subjects.

9. Many of the subjects were limited by the grip dynamometer in performing accurate measurements possibly due to their small hand size. The dynamometer's operation was confusing for the subjects to understand which part moved to produce a measurement reading.

Implications for Further Research

Contemporary views of research tend to find value only in findings that reach significant levels of probability. These views may not be realistic when reviewing research about possible physical changes in older adults. This study found significant levels of improvement on two variables, one physical and the other psychological. The other four physical variables did not reach significant levels of improvement. It should be emphasized that, although four of the physical variables did not improve to significant levels, they also did not decline during the course of this study. This lack of decline or the maintenance of a current level of functioning could be viewed as an improvement in performance

rather than lack of change because of the process of continued natural aging. Thus, no change in a physical variable in individuals in their eighth and ninth decade of life could have a positive relationship to reaching significant levels of improvement, which would increase the validity of research that deals with physical changes in older adults.

More research, specifically longitudinal research, is needed to evaluate the long-term effects of exercise on older adults who are mentally impaired, diseased, or physically handicapped. What are the long-term effects of exercise on these populations? Do individuals early in life have a tendency to develop maladies later in life as a result of quality and level of physical fitness? If the predisposition for the development of a malady is present early in life, can physical exercise alter or alleviate the symptoms later in life? From an economical standpoint, can exercise ameliorate the need for medications and other health care costs? Many variables make easy answers to these questions difficult but, through careful research and cooperation of all disciplines, this task can be accomplished.

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APPENDIX A

ILLUSTRATION OF INSTRUMENT USED FOR MEASURING

MODIFIED SIT AND REACH FLEXIBILITY

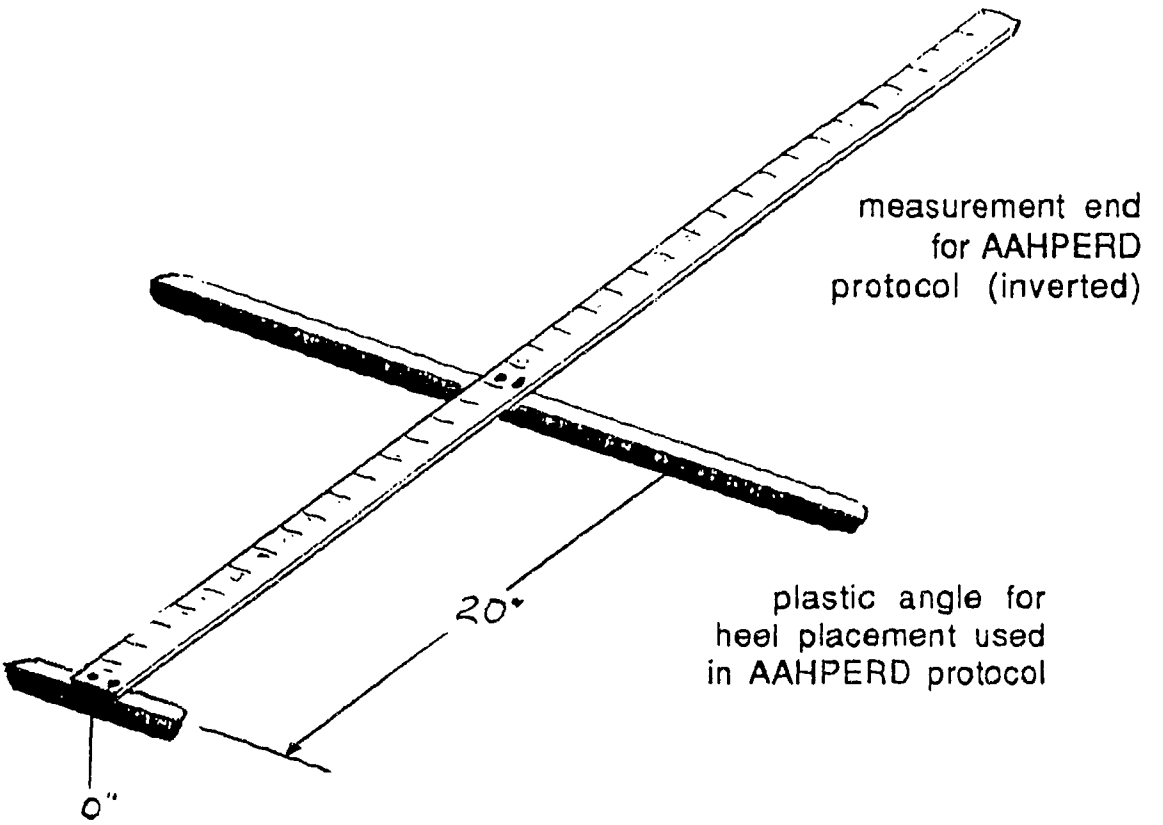

FIGURE 9